TOUCH PANEL

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a touch panel, and more particularly, relates to a touch panel providing electrostatic discharge (ESD) protection.

[0003] 2. Description of the Related Art

[0004] **FIG. 1** is a front view showing a conventional four-line touch panel. **FIG. 2** is a cross section taken along line A-A' of **FIG. 1**. Referring to **FIGS. 1 and 2**, the touch panel **101** includes a top transparent substrate **100**, a bottom transparent substrate **200**, and insulating spacers **600**. An ITO (indium tin oxide) film **120** is coated on the lower surface of the top transparent substrate **100**, and an ITO film **220** is coated on the upper surface of the bottom transparent substrate **200**. The insulating spacer **600** is disposed between the ITO film **120** of the top transparent substrate **100** and the ITO film **220** of the bottom transparent substrate **200** to separate the two ITO films.

[0005] An adhesive (such as a double-side adhesive) **500** is disposed between the edges of the top and bottom ITO films **120** and **220**, in order to separate the sensing line from another ITO film or from another sensing line. The areas on the edges of the panel where signal lines are located are labeled "S". The area outside of the sensing line area is an active area (AA).

[0006] External power is supplied to the touch panel **101**. When the top transparent substrate **100** is contacted by, for example, a finger or stylus, electric contact occurs between the two ITO films **120** and **220**. The relative change in voltage and/or current arising from such contact creates a signal that is sensed by the sensing lines **310**, **320**, **410** and **420**, and transmitted via transmission lines **310***a*, **320***a*, **410***a* and **420***a*.

[0007] **FIG. 3** shows a conventional display system **110** with a touch panel. As shown in **FIG. 3**, controller **103** computes the analog signal S1 transmitted from touch panel **101** to obtain the relative position of the contact point with respect to the active are AA, and the CPU **105** makes appropriate responses at the corresponding position on the LCD panel according to the obtained relative position. However, during operation of the display system, the electric elements in the controller **103** may burn out from electrostatic discharge through the touch panel **101**.

SUMMARY OF THE INVENTION

[0008] It is therefore an object of the present invention to prevent burnout in the controller from electrostatic discharge (ESD) through the touch panel.

[0009] According to the preceding object, the present invention provides a touch panel providing ESD protection. The touch panel is grounded to prevent electrostatic charges from reaching the sensing lines, transmission lines, and/or control electronics. A grounding conductor is attached to the touch panel.

[0010] In one embodiment of the touch panel of the present invention, a top transparent substrate includes a top conductive film on its lower surface. A bottom transparent substrate includes a bottom conductive film on its upper surface. An insulating spacer is located between the top conductive film and the bottom conductive film. Each of a plurality of sensing lines, is disposed on an edge of the top or bottom conductive film and separated from other conductive films or sensing lines by an adhesive. At least one grounding loop is isolated from the top conductive film and the bottom conductive film by an insulating region. The grounding loop is electrically coupled to an external ground terminal, thereby dissipating the electrostatic discharge.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The present invention can be more fully understood by the subsequent detailed description and examples with reference made to the accompanying drawings, wherein:

[0012] **FIG. 1** is a front view showing a conventional four-line touch panel;

[0013] **FIG. 2** is a cross section taken along line A-A' of **FIG. 1**;

[0014] **FIG. 3** shows a conventional display system with a touch panel;

[0015] **FIG. 4** is a front view showing a four-line touch panel according to one embodiment of the present invention;

[0016] **FIG. 5** is a cross section taken along line A-A' of **FIG. 4**.

[0017] **FIG. 6** is a schematic diagram of a display system with a touch panel of the present invention.

[0018] **FIG. 7** is a schematic diagram of an electronic device having a display with a touch panel of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0019] The following description is of the best-contemplated mode of carrying out the invention. This description is made for the purpose of illustrating the general principles of the invention and should not be taken in a limiting sense. The scope of the invention is best determined by reference to the appended claims.

[0020] It is noted that the description hereinbelow refers to various layers arranged on, above or overlying other layers, to describe the relative positions of the various layers. References to "on", "above", "overlying", or other similar languages, are not limited to the interpretation of one layer being immediately adjacent another layer. There may be intermediate or interposing layers, coatings, or other structures present, and associated process steps present, which are not shown or discussed herein, but could be included to accomplish the intended purpose without departing from the scope and spirit of the invention disclosed herein. Similar, references to structures adjacent, between or other positional references to other structures merely describe the relative positions of the structures, with or without intermediate structures.

[0021] **FIG. 4** is a front view showing a four-line touch panel according to one embodiment of the present invention. **FIG. 5** is a cross section taken along line A-A' of **FIG. 4**. Referring to **FIGS. 4 and 5**, the touch panel **11** of the present invention has a contact sensitive panel comprising a top transparent substrate **10**, a bottom transparent substrate **20**, insulating spacers **60**, and a plurality of sensing lines **31**, **32**,